

CHAPTER 12. UTILITY IMPACTS ANALYSIS

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CHAPTER 12. UTILITY IMPACTS ANALYSIS

12.1 SUMMARY

The effects of proposed clothes washer energy efficiency standards on the electricity and gas industries were analysed using a variant of the US Energy Information Administration's (DOE/EIA) National Energy Modelling System (NEMS), called NEMS-BRS, together with some exogenous calculations.^a NEMS was used by the EIA to produce the *Annual Energy Outlook 1999* (AEO99),¹ and NEMS-BRS is used to provide some key equivalent inputs to our standards analysis. Because electric utility restructuring is well underway, it is no longer valid to assume the traditional cost recovery regulation of utilities, which was the basis of previous utility impact analyses. Therefore, the utility analysis consists of a comparison between model results for a case comparable to the AEO99 Reference Case, as reported in the AEO99, and policy cases incorporating each of the clothes washer standards scenarios. In this analysis, the reference case refers to cases with respect to the AEO99 Reference Case, not to be confused with the price sensitivities whose results are compared with a base case trial standard level. Because the policy standards effects are too small to be seen in the context of the whole gas and electricity sector, NEMS-BRS is not used directly. Rather, exploratory runs are conducted to estimate marginal effects, which are then used to calculate the small effects on utilities due to each proposed standard case. The reduced electricity demand from clothes washer efficiency standards lowers generation from both coal and natural gas, but, because natural gas is more frequently the marginal fuel, it is usually affected to a greater degree, particularly early in the forecast period. Other generation is only minimally affected by the standard levels.

12.2 PURPOSE OF THE ANALYSIS

The requirement that the effects of proposed standards on electric utilities be analysed has a long history. Analysis of the effects of proposed standards on the electric utility industry has historically taken the form of estimated fuel savings and capital cost savings relative to the likely reduction in revenues implied by lower electricity sales. In the short term, ratepayers of traditional utilities gained because of reduced energy use at fixed prices, but any imbalance between revenue and costs disappeared in the long run, as traditional regulation ensured utilities would recover their costs. In a restructured industry, however, only transmission and distribution providers will be permitted to recoup costs, and energy prices are not rigid in the short-run, so the basis of our analysis must change. Using the AEO99 assumptions regarding the spread of restructuring allows us to use NEMS-BRS to estimate the overall effect of standards on the industry.^b We assess the impact of

^aFor more information on NEMS, please refer to the U.S. Department of Energy, Energy Information Administration documentation. A useful summary is *National Energy Modeling System: An Overview 1998*, DOE/EIA-0581(98), February 1998. DOE/EIA approves use of the name NEMS to describe only an official version of the model without any modification to code or data. Because our analysis entails some minor code modifications and the model is run under policy scenarios that are variations on DOE/EIA assumptions, the name NEMS-BRS refers to the model as used here (BRS is DOE's Building Research and Standards office, under whose aegis this work has been performed).

^b The EIA assumptions on restructuring are explained on page 14-15 and pages 24-29 of the AEO99.

standards on utilities by reporting several key industry parameters, notably energy sales, generation, and capacity.

No previous appliance standard setting process has considered the natural gas utility industry and coverage of natural gas here is modest. Analysis of the effects of standards on the natural gas sector is limited to the reporting of residential consumption of natural gas and the change in the contribution of natural gas to electric generation.

12.3 ASSUMPTIONS

NEMS-BRS has several advantages that have led to its adoption as the source for basic forecasting in the appliance energy efficiency analyses. NEMS-BRS relies upon a set of assumptions which are well known and fairly transparent due to the exposure and scrutiny each *AEO* receives. In addition, the comprehensiveness of NEMS-BRS permits the modelling of interactions among the various energy supply and demand sectors and the economy as a whole, so it produces a sophisticated picture of the effects of appliance standards. Perhaps most importantly, because it explicitly simulates the impact on the industry, NEMS-BRS provides accurate estimation of marginal effects, which yield better indicators of actual effects than estimates based on industry-wide average values. We chose marginal rates over average rates because we wanted to show the effects of proposed standards as well as what might also be happening in the market according to the *AEO99* Reference Case.

The utility analysis uses the assumptions of *AEO99* and treats clothes washer efficiency standards as variations in policy. Because the implementation of standards reduces demand by less than 1% of total US electricity generation in any given year, its effect can not be detected directly by simulations. Therefore, simulation runs are done for larger reductions in demand and results are interpolated between *AEO99* and these runs. We assume that the effects measured are linear within the range of interpolation. This issue is discussed further below and in Appendix EA-3.

Variations in some of these assumptions have also been explored through two scenarios that represent alternative futures based on the Low and High Economic Growth cases of *AEO99*, demonstrating the effects of alternative growth assumptions on energy markets. The growth assumptions for each case are based on macroeconomic forecasts prepared by DRI/McGraw-Hill². The *AEO99* Reference Case assumes a moderate rate of economic growth, 2.1 % a year from 1997-2020. The *AEO99* Low Economic Growth case is based on lower growth rates for population, labour force, and productivity, resulting in higher prices and interest rates and lower growth in industrial output. Economic output in the Low Economic Growth case increases by 1.5 % a year from 1997 through 2020. The *AEO99* High Economic Growth case incorporates higher growth rates for population, labour force, and labour productivity, resulting in lower inflation and interest rates and an increased projected economic output of 2.6 % a year. The energy savings estimates used to model the High and Low Economic Growth cases varied by a minor amount from that which we used

to model the standards levels in the Reference Case.^a

12.4 METHODS

NEMS is a large, multi-sectoral, partial equilibrium model of the US energy sector that has been developed over several years by the DOE/EIA, primarily for the purpose of preparing the *Annual Energy Outlook*. NEMS produces a widely recognized baseline forecast for the US. through 2020 and is available in the public domain. The NEMS-BRS model used for appliance standards analysis is based on the *AEO99* version of NEMS with minor modifications.

The current time horizon of NEMS-BRS is 2020, yet other parts of the appliance energy efficiency work reach 2030. It is not feasible to extend the forecast period of NEMS-BRS for the purposes of this analysis nor does EIA have an approved method for extrapolation of many outputs beyond 2020. While it might seem reasonable in general to make simple linear extrapolations of results, in practice this is not advisable because outputs could be contradictory. For example, changes in the fuel mix implied by extrapolations of those outputs could be inconsistent with the extrapolation of marginal emissions factors. An analysis of various trends sufficiently detailed to guarantee consistency is beyond the scope of this work, and, in any case, would involve a great deal of uncertainty. Therefore, all extrapolations beyond 2020 presented here are simple replications of year 2020 results. While these may seem unreasonable in some instances, in this way results are guaranteed to be consistent. As with the *AEO99* Reference Case in general, the implicit assumption is that the regulatory environment does not deviate from the current known situation during the extrapolation period. Only changes that have been announced with date-certain introduction are included in NEMS-BRS. To emphasize the extrapolated results wherever they appear, they are shaded in grey to distinguish them from actual NEMS-BRS results.

For fuel prices, we extrapolate to 2030 using the DOE/EIA approach for forecasting fuel prices for the Federal Energy Management Program (FEMP). To determine the regional price forecasts for petroleum products for the years 2020-2030, we use the projected average annual growth rate for the world oil price in combination with the refinery and distribution markups from the year 2020 onward. Similarly, natural gas prices are derived from the average annual growth rate over the years 1997 to 2020 in combination with regional price margins from the year 2020. Electricity prices are kept constant at 2020 levels because it is assumed that the transition to a restructured utility industry will be completed.

Policy runs are executed by reducing electricity, gas, oil, and LPG consumption into the NEMS-BRS Residential Demand Module. These energy reductions are applied to the clothes washer, clothes dryer and water heater end-uses, according to the share of the energy savings each of these appliances represent. Energy savings for each appliance are also divided among census regions based on the prevalence of each fuel in each end use, as determined by the *Residential Energy Consumption Survey* (RECS).³ All residential fuels are considered simultaneously, and the

^a Please see pages 39 and 45 of the *AEO99* for more details on growth assumptions.

load shape effects of improved clothes washer efficiency are thereby replicated as well as possible.

As mentioned above, the magnitude of energy decrement that would be required for NEMS-BRS to produce stable results safely out of the range of numerical noise is larger than even the most rigorous efficiency standard under consideration. Therefore, we estimated results in the range of the of the standard levels using interpolation. Reductions to the Residential Demand Module clothes washer, clothes dryer and water heater loads are implemented at sets of multipliers of each trial standard level. Actual standard level changes in generation and capacity due to the standard are then derived from these outputs. A detailed description of the interpolation methodology is given in Appendix EA-3.

12.5 RESULTS

The Table 12-1 shows the results from a NEMS-BRS run comparable to the published *AEO99* Reference Case, with results for the various trial standards cases presented in the parallel Tables 12-2 through 12-7. Each table shows forecasts using interpolated results as described in Section 12.4 above for residential energy sales and total US electric generation and installed capacity. As expected, gas-fired generation is somewhat more affected by the standard levels than coal-fired generation. This effect reflects the more load following role of gas generation overall.

Residential energy sales fall for each proposed standard level compared to the *AEO99* Reference Case. The decrease in sales is proportional to the amount of energy that the National Energy Savings (NES) model predicts will be saved by each standard, ranging from just over 0.07% to over 2% of total residential electricity sales and up to nearly 1.9% of total residential gas sales in the peak savings year reported. Total US generation decreases relative to the *AEO99* baseline in each standard case, from nearly 0.8% of total US electric generation in the peak year of the maximum savings case (MEF of 1.634, a 50% reduction in energy usage) to just under 0.03% in the peak year of the smallest savings case (MEF of 0.860, a 5% reduction in energy usage). The gas contribution to electric generation falls by about 1% in the peak year of the maximum savings case. Total installed capacity is also slightly reduced in each standard level scenario, by just over 1% in the final year of the maximum savings case.

The reduction in gas consumption at the power plant will, by and large, exceed the reduction in gas consumption at households, as a fraction of total projected gas savings. As an example, in the case of a 1.257 MEF (an energy usage reduction of 35%) , the reduction in gas consumed by the power sector in 2010 represents about 64% of total gas savings (with households contributing the remaining 36%). In 2020, the power sector savings represent about 48% of the total decrease in gas consumption. It is important to note that these savings, even at their highest level, are small compared to total power sector gas consumption, never exceeding 2% in any of the trial standard cases (or 0.6% of total US gas consumption). Furthermore, gas consumption in power generation is predicted by NEMS-BRS to approximately triple during the forecast period, reaching over 9.9 EJ (9.4 Quads) by 2020. Residential gas consumption is also forecast by NEMS-BRS to increase over time, though not nearly as dramatically, as does gas demand in other sectors.

In addition to the analysis based on standards with respect to the *AEO99* Reference Case, two sets of sensitivities were run for the negotiated proposed two-tier standard of a 1.04 MEF (Modified Energy Factor) becoming effective in 2004 and a 1.26 MEF effective in 2007. The sensitivities run were for the *AEO99* High and Low Economic Growth scenario and for high and low clothes washer shipment forecasts due to high and low elasticity assumptions (see NES and Shipments chapters for more detailed discussion). The results for the high and low elasticity sensitivities are provided in Tables 12-8 and 12-9 and are run with respect to *AEO99* Reference Case. For the Low (High) Economic Growth Case, the savings have a slightly lower (higher) impact for each of the reported industry parameters relative to the *AEO99* Reference Case. Results for these *AEO99* Economic Growth cases are shown in Tables 12-10 and 12-11.

Table 12.1 AEO99 Reference Case Forecast

NEMS-BRS Results: AEO99 Reference					
	2000	2005	2010	2015	2020
Residential Sector Energy Consumption¹					
Electricity Sales (TWh) ²	1,175	1,262	1,341	1,445	1,557
Natural Gas (EJ)	5.5	5.6	5.8	6.1	6.3
Other (EJ)	2.2	2.1	2.0	2.0	1.9
Natural Gas (Quads)	5.2	5.3	5.5	5.8	5.9
Other (Quads) ³	2.0	2.0	1.9	1.9	1.8
Total US Electric Generation⁴					
Coal (TWh)	1,990	2,037	2,092	2,204	2,348
Gas (TWh)	547	858	1,149	1,441	1,588
Petroleum (TWh)	109	44	35	33	31
Nuclear (TWh)	660	631	554	419	359
Renewables (TWh)	423	433	446	461	483
Total (TWh) ⁵	3,729	4,003	4,276	4,558	4,809
Installed Generating Capacity⁶					
Coal (GW)	315.2	315.0	318.9	326.2	343.5
Other Fossil (GW) ⁷	301.5	369.7	397.3	470.1	513.5
Nuclear (GW)	94.8	87.4	74.2	56.4	48.9
Renewables (GW)	97.2	98.9	100.3	102.3	105.4
Total (GW) ⁸	808.7	871.0	890.7	955.0	1,011.3

¹ Comparable to Table A2 of AEO99: Energy Consumption, Residential

² Comparable to Table A8 of AEO99: Electricity Sales by Sector

³ Includes distillate fuel, residential fuel, kerosene, LPG, motor gasoline, coal, and renewable energy

⁴ Comparable to Table A8 of AEO99: Electric Generators and Cogenerators

⁵ Excludes "Other Gaseous Fuels" cogenerators and "Other" cogenerators

⁶ Comparable to Table A9 of AEO99: Electric Generators and Cogenerators Capability

⁷ Includes "Other Gaseous Fuels" cogenerators

⁸ Excludes Pumped Storage and Fuel Cells

Table 12.2 MEF = 1.634 (50% Reduction in Energy Usage Forecast)

NEMS-BRS Results						Difference from AEO99 Reference (Annual)						
											Extrapolation	
	2000	2005	2010	2015	2020	2000	2005	2010	2015	2020	2025	2030
Residential Sector Energy Consumption												
Electricity Sales (TWh)	1,175	1,258	1,327	1,420	1,525	0.0	-4.0	-13.9	-25.4	-31.9	-33.8	-35.2
Natural Gas (EJ)	5.50	5.59	5.77	6.00	6.15	0.00	-0.01	-0.05	-0.09	-0.11	-0.12	-0.13
Other (EJ)	2.15	2.06	2.01	1.95	1.92	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01
Natural Gas (Quads)	5.21	5.30	5.47	5.68	5.83	0.00	-0.01	-0.05	-0.09	-0.11	-0.11	-0.12
Other (Quads)	2.04	1.95	1.90	1.85	1.82	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01
Total US Electric Generation												
Coal (TWh)	1,990	2,035	2,090	2,197	2,329	0.0	-2.0	-1.9	-7.3	-18.9	-18.9	-18.9
Gas (TWh)	547	856	1,136	1,421	1,573	-0.2	-2.2	-12.9	-19.5	-15.2	-15.2	-15.2
Petroleum (TWh)	109	44	35	32	31	0.0	-0.5	-0.4	-0.5	-0.3	-0.3	-0.3
Nuclear (TWh)	660	631	554	419	359	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewables (TWh)	423	433	446	460	481	0.0	0.0	0.0	-0.5	-1.7	-1.7	-1.7
Total (TWh)	3,729	3,998	4,261	4,530	4,773	-0.2	-4.7	-15.2	-27.9	-36.2	-36.2	-36.2
Installed Generating Capacity												
Coal (GW)	315.2	315.0	318.8	325.7	341.3	0.0	0.0	-0.1	-0.5	-2.2	-2.2	-2.2
Other Fossil (GW)	301.5	369.6	394.1	463.9	505.6	0.0	-0.1	-3.2	-6.2	-7.9	-7.9	-7.9
Nuclear (GW)	94.8	87.4	74.2	56.4	48.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewables (GW)	97.2	98.9	100.3	102.2	105.2	0.0	0.0	0.0	-0.1	-0.2	-0.2	-0.2
Total (GW)	808.7	870.9	887.4	948.2	1,001.0	0.0	-0.1	-3.3	-6.8	-10.3	-10.3	-10.3

Table 12.3 MEF = 1.362 (40% Reduction in Energy Usage Forecast)

NEMS-BRS Results						Difference from AEO99 Reference						
											Extrapolation	
	2000	2005	2010	2015	2020	2000	2005	2010	2015	2020	2025	2030
Residential Sector Energy Consumption												
Electricity Sales (TWh)	1,175	1,259	1,330	1,426	1,534	0.0	-3.1	-10.7	-19.1	-23.4	-24.5	-25.4
Natural Gas (EJ)	5.50	5.59	5.78	6.00	6.16	0.00	-0.01	-0.05	-0.08	-0.10	-0.11	-0.11
Other (EJ)	2.15	2.06	2.01	1.95	1.92	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01
Natural Gas (Quads)	5.21	5.30	5.48	5.69	5.84	0.00	-0.01	-0.04	-0.08	-0.10	-0.10	-0.11
Other (Quads)	2.04	1.95	1.90	1.85	1.82	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01
Total US Electric Generation												
Coal (TWh)	1,990	2,036	2,090	2,198	2,334	0.0	-1.5	-2.2	-5.8	-14.5	-14.5	-14.5
Gas (TWh)	547	856	1,140	1,426	1,577	-0.1	-1.7	-9.2	-14.7	-10.6	-10.6	-10.6
Petroleum (TWh)	109	44	35	33	31	0.0	-0.3	-0.3	-0.4	-0.2	-0.2	-0.2
Nuclear (TWh)	660	631	554	419	359	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewables (TWh)	423	433	446	461	482	0.0	0.0	0.0	-0.4	-1.3	-1.3	-1.3
Total (TWh)	3,729	3,999	4,264	4,537	4,782	-0.1	-3.5	-11.7	-21.3	-26.6	-26.6	-26.6
Installed Generating Capacity												
Coal (GW)	315.2	315.0	318.8	325.7	341.8	0.0	0.0	-0.1	-0.5	-1.7	-1.7	-1.7
Other Fossil (GW)	301.5	369.6	395.0	466.1	508.7	0.0	-0.1	-2.3	-4.0	-4.8	-4.8	-4.8
Nuclear (GW)	94.8	87.4	74.2	56.4	48.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewables (GW)	97.2	98.9	100.3	102.3	105.2	0.0	0.0	0.0	0.0	-0.2	-0.2	-0.2
Total (GW)	808.7	870.9	888.3	950.5	1,004.6	0.0	-0.1	-2.4	-4.5	-6.7	-6.7	-6.7

Table 12.4 MEF = 1.257 (35% Reduction in Energy Usage Forecast)

NEMS-BRS Results						Difference from AEO99 Reference						
											Extrapolation	
	2000	2005	2010	2015	2020	2000	2005	2010	2015	2020	2025	2030
Residential Sector Energy Consumption												
Electricity Sales (TWh)	1,175	1,259	1,330	1,426	1,534	0.0	-3.1	-10.6	-18.9	-23.2	-24.3	-25.1
Natural Gas (EJ)	5.50	5.59	5.78	6.00	6.16	0.00	-0.01	-0.05	-0.08	-0.10	-0.11	-0.11
Other (EJ)	2.15	2.06	2.01	1.95	1.92	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01
Natural Gas (Quads)	5.21	5.30	5.48	5.69	5.84	0.00	-0.01	-0.04	-0.08	-0.10	-0.10	-0.11
Other (Quads)	2.04	1.95	1.90	1.85	1.82	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01
Total US Electric Generation												
Coal (TWh)	1,990	2,036	2,090	2,198	2,334	0.0	-1.2	-2.1	-5.8	-14.1	-14.1	-14.1
Gas (TWh)	547	856	1,140	1,426	1,577	-0.1	-1.8	-9.2	-14.6	-10.7	-10.7	-10.7
Petroleum (TWh)	109	44	35	33	31	0.0	-0.3	-0.2	-0.4	-0.2	-0.2	-0.2
Nuclear (TWh)	660	631	554	419	359	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewables (TWh)	423	433	446	461	482	0.0	0.0	0.0	-0.4	-1.3	-1.3	-1.3
Total (TWh)	3,729	4,000	4,264	4,537	4,783	-0.1	-3.3	-11.6	-21.2	-26.4	-26.4	-26.4
Installed Generating Capacity												
Coal (GW)	315.2	315.0	318.8	325.8	341.8	0.0	0.0	-0.1	-0.4	-1.7	-1.7	-1.7
Other Fossil (GW)	301.5	369.6	395.1	466.1	508.8	0.0	-0.1	-2.2	-4.0	-4.7	-4.7	-4.7
Nuclear (GW)	94.8	87.4	74.2	56.4	48.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewables (GW)	97.2	98.9	100.3	102.2	105.2	0.0	0.0	0.0	-0.1	-0.2	-0.2	-0.2
Total (GW)	808.7	870.9	888.4	950.5	1,004.7	0.0	-0.1	-2.3	-4.5	-6.6	-6.6	-6.6

Table 12.5 MEF = 1.089 (25% Reduction in Energy Usage Forecast)

NEMS-BRS Results						Difference from AEO99 Reference						
											Extrapolation	
	2000	2005	2010	2015	2020	2000	2005	2010	2015	2020	2025	2030
Residential Sector Energy Consumption												
Electricity Sales (TWh)	1,175	1,260	1,335	1,434	1,543	0.0	-1.8	-6.5	-11.3	-13.6	-14.2	-14.7
Natural Gas (EJ)	5.50	5.59	5.79	6.02	6.19	0.00	-0.01	-0.04	-0.07	-0.08	-0.08	-0.09
Other (EJ)	2.15	2.06	2.01	1.95	1.92	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01
Natural Gas (Quads)	5.21	5.30	5.48	5.71	5.86	0.00	-0.01	-0.04	-0.06	-0.08	-0.08	-0.08
Other (Quads)	2.04	1.95	1.90	1.85	1.82	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01
Total US Electric Generation												
Coal (TWh)	1,990	2,036	2,091	2,200	2,339	0.0	-0.9	-1.1	-3.6	-9.1	-9.1	-9.1
Gas (TWh)	547	857	1,143	1,432	1,582	-0.1	-0.8	-5.8	-8.6	-5.6	-5.6	-5.6
Petroleum (TWh)	109	44	35	33	31	0.0	-0.2	-0.1	-0.3	-0.2	-0.2	-0.2
Nuclear (TWh)	660	631	554	419	359	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewables (TWh)	423	433	446	461	482	0.0	0.0	0.0	-0.3	-0.9	-0.9	-0.9
Total (TWh)	3,729	4,001	4,269	4,545	4,793	-0.1	-2.0	-7.0	-12.7	-15.7	-15.7	-15.7
Installed Generating Capacity												
Coal (GW)	315.2	315.0	318.9	326.0	342.4	0.0	0.0	0.0	-0.2	-1.1	-1.1	-1.1
Other Fossil (GW)	301.5	369.6	395.9	467.7	510.9	0.0	-0.1	-1.4	-2.4	-2.6	-2.6	-2.6
Nuclear (GW)	94.8	87.4	74.2	56.4	48.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewables (GW)	97.2	98.9	100.3	102.3	105.3	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1
Total (GW)	808.7	870.9	889.2	952.3	1,007.5	0.0	-0.1	-1.5	-2.7	-3.8	-3.8	-3.8

Table 12.6 MEF = 1.021 (20% Reduction in Energy Usage Forecast)

NEMS-BRS Results						Difference from AEO99 Reference						
											Extrapolation	
	2000	2005	2010	2015	2020	2000	2005	2010	2015	2020	2025	2030
Residential Sector Energy Consumption												
Electricity Sales (TWh)	1,175	1,261	1,338	1,439	1,550	0.0	-1.0	-3.4	-5.9	-7.1	-7.4	-7.6
Natural Gas (EJ)	5.50	5.60	5.80	6.05	6.22	0.00	-0.01	-0.02	-0.04	-0.04	-0.04	-0.05
Other (EJ)	2.15	2.06	2.01	1.95	1.92	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01
Natural Gas (Quads)	5.21	5.30	5.50	5.74	5.90	0.00	-0.01	-0.02	-0.03	-0.04	-0.04	-0.04
Other (Quads)	2.04	1.95	1.90	1.85	1.82	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01
Total US Electric Generation												
Coal (TWh)	1,990	2,037	2,091	2,202	2,343	0.0	-0.5	-0.6	-2.1	-4.8	-4.8	-4.8
Gas (TWh)	547	858	1,146	1,437	1,585	0.0	-0.5	-3.1	-4.4	-2.9	-2.9	-2.9
Petroleum (TWh)	109	44	35	33	31	0.0	-0.1	-0.1	-0.2	-0.1	-0.1	-0.1
Nuclear (TWh)	660	631	554	419	359	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewables (TWh)	423	433	446	461	483	0.0	0.0	0.0	-0.1	-0.4	-0.4	-0.4
Total (TWh)	3,729	4,002	4,272	4,551	4,801	0.0	-1.1	-3.8	-6.7	-8.3	-8.3	-8.3
Installed Generating Capacity												
Coal (GW)	315.2	315.0	318.9	326.1	342.9	0.0	0.0	0.0	-0.1	-0.6	-0.6	-0.6
Other Fossil (GW)	301.5	369.7	396.6	469.0	512.4	0.0	0.0	-0.7	-1.1	-1.1	-1.1	-1.1
Nuclear (GW)	94.8	87.4	74.2	56.4	48.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewables (GW)	97.2	98.9	100.3	102.3	105.3	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1
Total (GW)	808.7	871.0	890.0	953.8	1,009.6	0.0	0.0	-0.7	-1.2	-1.7	-1.7	-1.7

Table 12.7 MEF 1.04 in 2004 and 1.26 in 2007; 2-Tier Forecast; Trial Standard Level 3

NEMS-BRS Results						Difference from AEO99 Reference						
											Extrapolation	
	2000	2005	2010	2015	2020	2000	2005	2010	2015	2020	2025	2030
Residential Sector Energy Consumption												
Electricity Sales (TWh)	1,175	1,261	1,333	1,429	1,534	0.0	-1.2	-8.0	-16.1	-22.6	-24.2	-25.1
Natural Gas (EJ)	5.50	5.60	5.79	6.01	6.17	0.00	-0.01	-0.04	-0.07	-0.10	-0.11	-0.11
Other (EJ)	2.15	2.06	2.01	1.95	1.92	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01
Natural Gas (Quads)	5.21	5.30	5.48	5.70	5.84	0.00	-0.01	-0.04	-0.07	-0.10	-0.10	-0.11
Other (Quads)	2.04	1.95	1.91	1.85	1.82	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01
Total US Electric Generation												
Coal (TWh)	1,990	2,037	2,091	2,199	2,335	0.0	-0.5	-1.1	-5.2	-12.6	-12.6	-12.6
Gas (TWh)	547	857	1,142	1,429	1,576	-0.1	-0.7	-7.5	-12.2	-11.9	-11.9	-11.9
Petroleum (TWh)	109	44	35	33	31	0.0	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1
Nuclear (TWh)	660	631	554	419	359	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewables (TWh)	423	433	446	461	482	0.0	0.0	-0.1	-0.4	-1.1	-1.1	-1.1
Total (TWh)	3,729	4,002	4,267	4,540	4,783	-0.1	-1.3	-8.7	-17.9	-25.7	-25.7	-25.7
Installed Generating Capacity												
Coal (GW)	315.2	315.0	318.9	325.8	342.1	0.0	0.0	0.0	-0.4	-1.4	-1.4	-1.4
Other Fossil (GW)	301.5	369.6	396.0	466.6	509.0	0.0	-0.1	-1.3	-3.5	-4.5	-4.5	-4.5
Nuclear (GW)	94.8	87.4	74.2	56.4	48.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewables (GW)	97.2	98.9	100.3	102.3	105.2	0.0	0.0	0.0	0.0	-0.2	-0.2	-0.2
Total (GW)	808.7	870.9	889.4	951.1	1,005.2	0.0	-0.1	-1.3	-3.9	-6.1	-6.1	-6.1

Table 12.8 MEF 1.04 in 2004 and 1.26 in 2007; 2-Tier High Elasticity Sensitivity Forecast

NEMS-BRS Results						Difference from AEO99 Reference						
											Extrapolation	
	2000	2005	2010	2015	2020	2000	2005	2010	2015	2020	2025	2030
Residential Sector Energy Consumption												
Electricity Sales (TWh)	1,175	1,261	1,333	1,430	1,535	0.0	-1.2	-7.5	-15.4	-22.4	-24.6	-25.7
Natural Gas (EJ)	5.50	5.60	5.79	6.02	6.17	0.00	-0.01	-0.04	-0.07	-0.10	-0.11	-0.11
Other (EJ)	2.15	2.06	2.01	1.95	1.92	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01
Natural Gas (Quads)	5.21	5.30	5.49	5.70	5.84	0.00	-0.01	-0.03	-0.07	-0.10	-0.10	-0.11
Other (Quads)	2.04	1.95	1.91	1.85	1.82	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01
Total US Electric Generation												
Coal (TWh)	1,990	2,036	2,091	2,199	2,335	0.0	-0.6	-1.2	-5.0	-12.7	-12.7	-12.7
Gas (TWh)	547	858	1,142	1,429	1,576	-0.1	-0.5	-6.7	-11.6	-11.7	-11.7	-11.7
Petroleum (TWh)	109	44	35	33	31	0.0	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1
Nuclear (TWh)	660	631	554	419	359	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewables (TWh)	423	433	446	461	482	0.0	0.0	0.0	-0.4	-1.1	-1.1	-1.1
Total (TWh)	3,729	4,002	4,268	4,541	4,783	-0.1	-1.3	-8.1	-17.2	-25.6	-25.6	-25.6
Installed Generating Capacity												
Coal (GW)	315.2	315.0	318.9	325.9	342.1	0.0	0.0	0.0	-0.3	-1.4	-1.4	-1.4
Other Fossil (GW)	301.5	369.6	396.1	466.8	509.1	0.0	-0.1	-1.2	-3.3	-4.4	-4.4	-4.4
Nuclear (GW)	94.8	87.4	74.2	56.4	48.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewables (GW)	97.2	98.9	100.3	102.3	105.2	0.0	0.0	0.0	0.0	-0.2	-0.2	-0.2
Total (GW)	808.7	870.9	889.5	951.4	1,005.4	0.0	-0.1	-1.2	-3.6	-5.9	-5.9	-5.9

Table 12.9 MEF 1.04 in 2004 and 1.26 in 2007; 2-Tier Medium Price/Income Sensitivity Forecast

NEMS-BRS Results						Difference from AEO99 Reference						
											Extrapolation	
	2000	2005	2010	2015	2020	2000	2005	2010	2015	2020	2025	2030
Residential Sector Energy Consumption												
Electricity Sales (TWh)	1,175	1,261	1,333	1,428	1,534	0.0	-1.2	-8.3	-16.7	-23.0	-24.4	-25.3
Natural Gas (EJ)	5.50	5.60	5.78	6.01	6.16	0.00	-0.01	-0.04	-0.08	-0.10	-0.11	-0.11
Other (EJ)	2.15	2.06	2.01	1.95	1.92	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01
Natural Gas (Quads)	5.21	5.30	5.48	5.70	5.84	0.00	-0.01	-0.04	-0.07	-0.10	-0.10	-0.11
Other (Quads)	2.04	1.95	1.91	1.85	1.82	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01
Total US Electric Generation												
Coal (TWh)	1,990	2,036	2,091	2,199	2,335	0.0	-0.6	-1.1	-5.1	-12.8	-12.8	-12.8
Gas (TWh)	547	857	1,141	1,428	1,576	-0.1	-0.6	-7.7	-12.9	-12.1	-12.1	-12.1
Petroleum (TWh)	109	44	35	33	31	0.0	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1
Nuclear (TWh)	660	631	554	419	359	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewables (TWh)	423	433	446	461	482	0.0	0.0	-0.1	-0.4	-1.1	-1.1	-1.1
Total (TWh)	3,729	4,002	4,267	4,539	4,783	-0.1	-1.4	-9.0	-18.5	-26.0	-26.0	-26.0
Installed Generating Capacity												
Coal (GW)	315.2	315.0	318.9	325.9	342.0	0.0	0.0	0.0	-0.3	-1.5	-1.5	-1.5
Other Fossil (GW)	301.5	369.6	396.0	466.4	509.0	0.0	-0.1	-1.3	-3.7	-4.5	-4.5	-4.5
Nuclear (GW)	94.8	87.4	74.2	56.4	48.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewables (GW)	97.2	98.9	100.3	102.3	105.2	0.0	0.0	0.0	0.0	-0.2	-0.2	-0.2
Total (GW)	808.7	870.9	889.4	951.0	1,005.1	0.0	-0.1	-1.3	-4.0	-6.2	-6.2	-6.2

Table 12.10 MEF 1.04 in 2004 and 1.26 in 2007; 2-Tier High Economic Growth Forecast

NEMS-BRS Results						Difference from AEO99 Reference						
											Extrapolation	
	2000	2005	2010	2015	2020	2000	2005	2010	2015	2020	2025	2030
Residential Sector Energy Consumption												
Electricity Sales (TWh)	1,179	1,284	1,375	1,489	1,615	0.0	-1.2	-8.0	-16.1	-22.6	-24.2	-25.1
Natural Gas (EJ)	5.52	5.70	6.01	6.33	6.56	0.00	-0.01	-0.04	-0.07	-0.10	-0.11	-0.11
Other (EJ)	2.17	2.09	2.04	2.01	1.97	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01
Natural Gas (Quads)	5.23	5.40	5.69	6.00	6.21	0.00	-0.01	-0.04	-0.07	-0.10	-0.10	-0.11
Other (Quads)	2.06	1.98	1.94	1.90	1.87	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01
Total US Electric Generation												
Coal (TWh)	1,993	2,065	2,148	2,300	2,539	0.0	-0.4	-1.5	-6.3	-16.8	-16.8	-16.8
Gas (TWh)	557	929	1,253	1,577	1,701	0.0	-0.8	-7.1	-11.1	-6.8	-6.8	-6.8
Petroleum (TWh)	108	44	35	34	32	0.0	-0.1	-0.3	-0.3	-0.1	-0.1	-0.1
Nuclear (TWh)	660	631	554	419	373	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewables (TWh)	424	437	454	479	516	0.0	0.0	-0.1	-0.5	-1.3	-1.3	-1.3
Total (TWh)	3,742	4,106	4,443	4,809	5,161	0.0	-1.3	-9.0	-18.2	-25.0	-25.0	-25.0
Installed Generating Capacity												
Coal (GW)	315.2	315.3	322.0	335.0	365.2	0.0	0.0	0.0	-0.5	-2.0	-2.0	-2.0
Other Fossil (GW)	303.4	385.4	426.7	506.1	552.3	0.0	0.0	-1.2	-3.3	-3.7	-3.7	-3.7
Nuclear (GW)	94.8	87.4	74.2	56.4	50.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewables (GW)	97.3	99.2	101.4	104.7	109.7	0.0	0.0	0.0	-0.1	-0.2	-0.2	-0.2
Total (GW)	810.7	887.3	924.2	1,002.2	1,078.0	0.0	0.0	-1.3	-3.9	-5.9	-5.9	-5.9

Table 12.11 MEF 1.04 in 2004 and 1.26 in 2007; 2-Tier Low Economic Growth Forecast

NEMS-BRS Results						Difference from AEO99 Reference						
											Extrapolation	
	2000	2005	2010	2015	2020	2000	2005	2010	2015	2020	2025	2030
Residential Sector Energy Consumption												
Electricity Sales (TWh)	1,172	1,240	1,296	1,373	1,456	0.0	-1.2	-8.0	-16.1	-22.6	-24.2	-25.1
Natural Gas (EJ)	5.48	5.48	5.56	5.70	5.77	0.00	-0.01	-0.04	-0.07	-0.10	-0.11	-0.11
Other (EJ)	2.14	2.04	1.96	1.90	1.87	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01
Natural Gas (Quads)	5.19	5.19	5.27	5.40	5.46	0.00	-0.01	-0.04	-0.07	-0.10	-0.10	-0.11
Other (Quads)	2.03	1.93	1.86	1.80	1.77	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01
Total US Electric Generation												
Coal (TWh)	1,982	2,000	2,057	2,125	2,185	0.0	-0.1	-2.5	-4.5	-9.6	-9.6	-9.6
Gas (TWh)	541	798	1,017	1,264	1,402	0.0	-1.0	-6.3	-12.9	-12.5	-12.5	-12.5
Petroleum (TWh)	110	43	33	30	28	0.0	-0.1	-0.3	-0.2	-0.2	-0.2	-0.2
Nuclear (TWh)	660	627	551	411	343	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewables (TWh)	423	432	440	449	459	0.0	0.0	0.0	-0.3	-0.7	-0.7	-0.7
Total (TWh)	3,716	3,900	4,098	4,279	4,418	0.0	-1.2	-9.1	-17.9	-23.0	-23.0	-23.0
Installed Generating Capacity												
Coal (GW)	315.1	314.6	315.6	319.6	326.6	0.0	0.0	-0.1	-0.3	-0.9	-0.9	-0.9
Other Fossil (GW)	300.8	355.4	368.5	429.6	462.2	0.0	0.0	-1.2	-3.6	-4.5	-4.5	-4.5
Nuclear (GW)	94.8	86.6	73.4	55.3	47.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Renewables (GW)	97.1	98.7	99.7	100.9	102.5	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1
Total (GW)	807.8	855.3	857.2	905.3	938.3	0.0	0.0	-1.3	-4.0	-5.5	-5.5	-5.5

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